

REPORT DOCUMENTATION PAGE

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| Unclassified | Unclassified | Unclassified | | |
| | | | 19b. TELEPHONE NUMBER (include area code) (661) 275-5015 | |

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18

3b Separate sheets are enclosed

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MEMORANDUM FOR PRR (Contractor/In-House Publication)

FROM: PROI (TI) (STINFO)

02 Aug 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-159**
Liu, C.T. (AFRL/PRSM); Wang, L., Atluri, S.N. (UCLA), "Analysis of Subinterface Cracks"

International Conference on Computational Science (Statement A)
(Anaheim CA, 21-25 Aug 00) **(Submission Deadline: 16 Aug 00)**

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

Comments: _____

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3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b.) appropriateness of distribution statement, c.) military/national critical technology, d.) economic sensitivity, e.) parallel review completed if required, and f.) format and completion of meeting clearance form if required

Comments: _____

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4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

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20021119 133

Analysis of Subinterface Cracks

A1890



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Approved

Distribution Statement: Cleared for Public Release

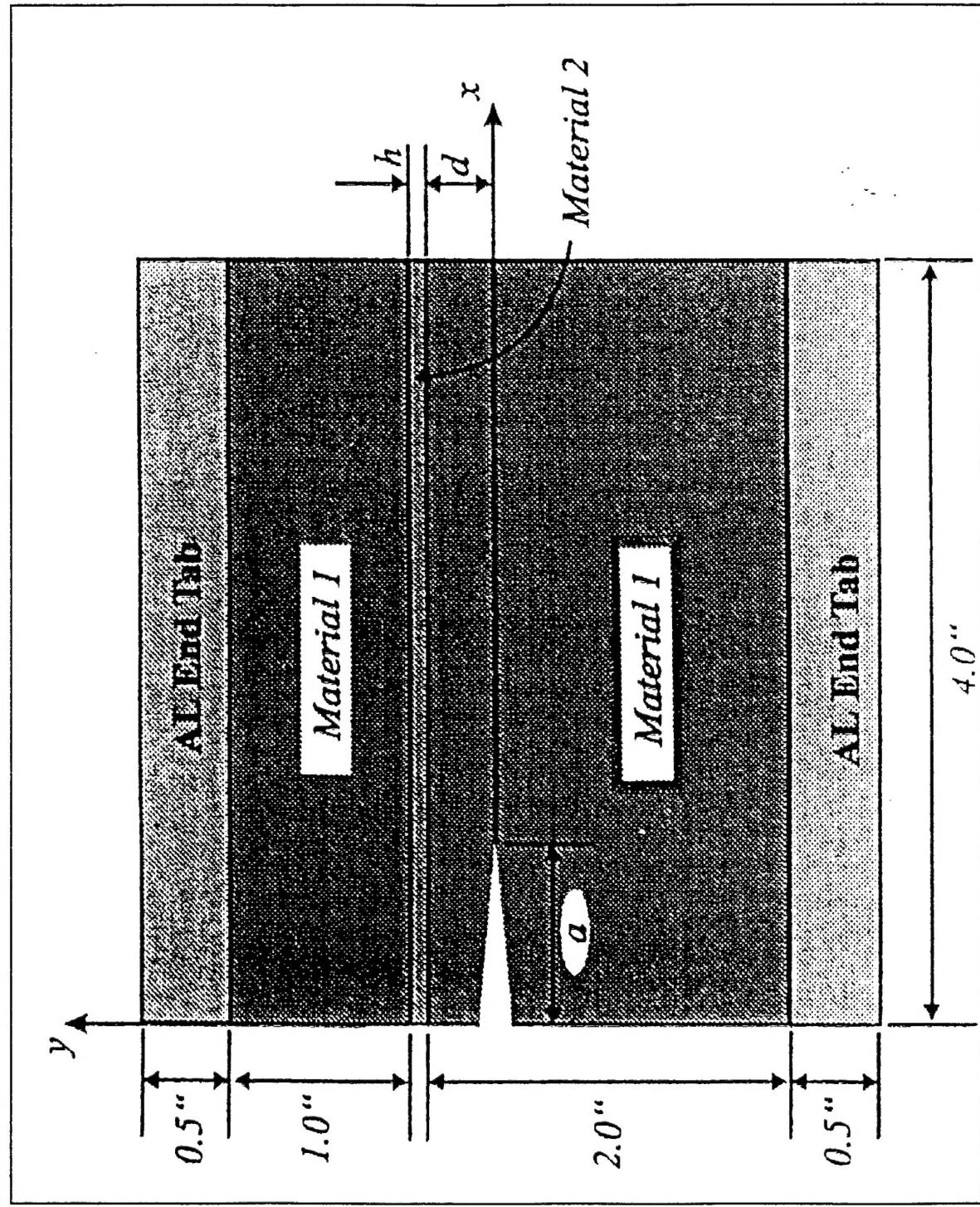
Objectives



- Determine the Accuracy of the Numerical Modeling Results.
- Investigate the Effects of (a) Crack Length and Location and (b) Adhesive Layer Thickness and Material property on Mode I Stress Intensity Factor.

Specimen Geometry

A1900



Definitions of the Analyzed Cases

| No. | E (ksi) | h (in) | d (in) | a (in) |
|-----|---------|--------|--------|--------|
| 1 | 700 | 0.10 | 0.15 | 0.10 |
| 2 | 700 | 0.10 | 0.15 | 0.50 |
| 3 | 100 | 0.05 | 0.15 | 0.10 |
| 4 | 100 | 0.05 | 0.15 | 0.50 |
| 5 | 100 | 0.05 | 0.30 | 0.10 |
| 6 | 100 | 0.05 | 0.30 | 0.10 |
| 7 | 100 | 0.20 | 0.15 | 0.10 |
| 8 | 100 | 0.20 | 0.15 | 0.50 |
| 9 | 100 | 0.20 | 0.30 | 0.10 |
| 10 | 100 | 0.20 | 0.30 | 0.50 |
| 11 | 1000 | 0.05 | 0.15 | 0.10 |
| 12 | 1000 | 0.05 | 0.15 | 0.50 |
| 13 | 1000 | 0.05 | 0.30 | 0.10 |
| 14 | 1000 | 0.05 | 0.30 | 0.50 |
| 15 | 1000 | 0.20 | 0.15 | 0.10 |
| 16 | 1000 | 0.20 | 0.15 | 0.50 |
| 17 | 1000 | 0.20 | 0.30 | 0.10 |
| 18 | 1000 | 0.20 | 0.30 | 0.50 |



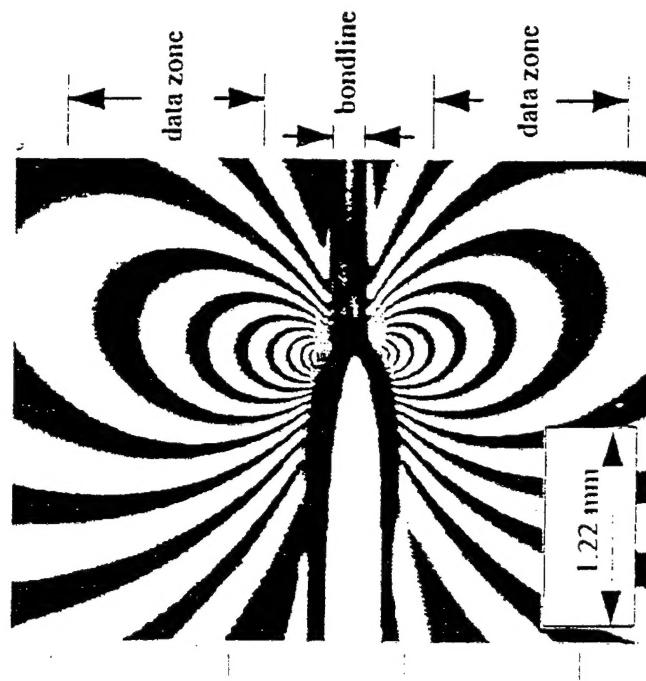
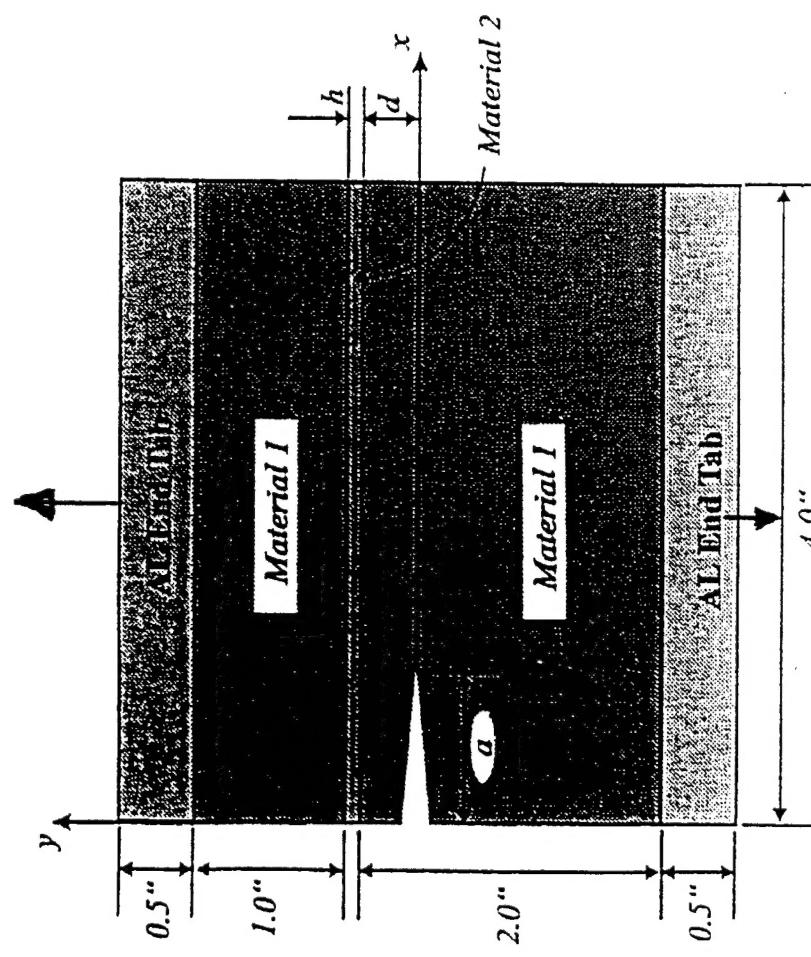
Summary of the Analyzed Cases

| No. | E (ksi) | h (in) | d (in) | a (in) | K/K _o |
|-----|---------|--------|--------|--------|------------------|
| 1 | 700 | 0.10 | 0.15 | 0.10 | 0.8958 |
| 2 | 700 | 0.10 | 0.15 | 0.50 | 0.8702 |
| 3 | 100 | 0.05 | 0.15 | 0.10 | 0.9795 |
| 4 | 100 | 0.05 | 0.15 | 0.50 | 0.9187 |
| 5 | 100 | 0.05 | 0.30 | 0.10 | 0.9551 |
| 6 | 100 | 0.05 | 0.30 | 0.10 | 0.9134 |
| 7 | 100 | 0.20 | 0.15 | 0.10 | 1.1429 |
| 8 | 100 | 0.20 | 0.15 | 0.50 | 1.0478 |
| 9 | 100 | 0.20 | 0.30 | 0.10 | 1.0687 |
| 10 | 100 | 0.20 | 0.30 | 0.50 | 1.0401 |
| 11 | 1000 | 0.05 | 0.15 | 0.10 | 0.8918 |
| 12 | 1000 | 0.05 | 0.15 | 0.50 | 0.8636 |
| 13 | 1000 | 0.05 | 0.30 | 0.10 | 0.9083 |
| 14 | 1000 | 0.05 | 0.30 | 0.50 | 0.8648 |
| 15 | 1000 | 0.20 | 0.15 | 0.10 | 0.8972 |
| 16 | 1000 | 0.20 | 0.15 | 0.50 | 0.8699 |
| 17 | 1000 | 0.20 | 0.30 | 0.10 | 0.9137 |
| 18 | 1000 | 0.20 | 0.30 | 0.50 | 0.8720 |





Comparison of Experimental and Numerical K_I/K_{IO}



Near Tip Fringe Pattern

$$\left(\frac{K_I}{K_{IO}}\right)_{\text{Exp}} = 0.8960$$

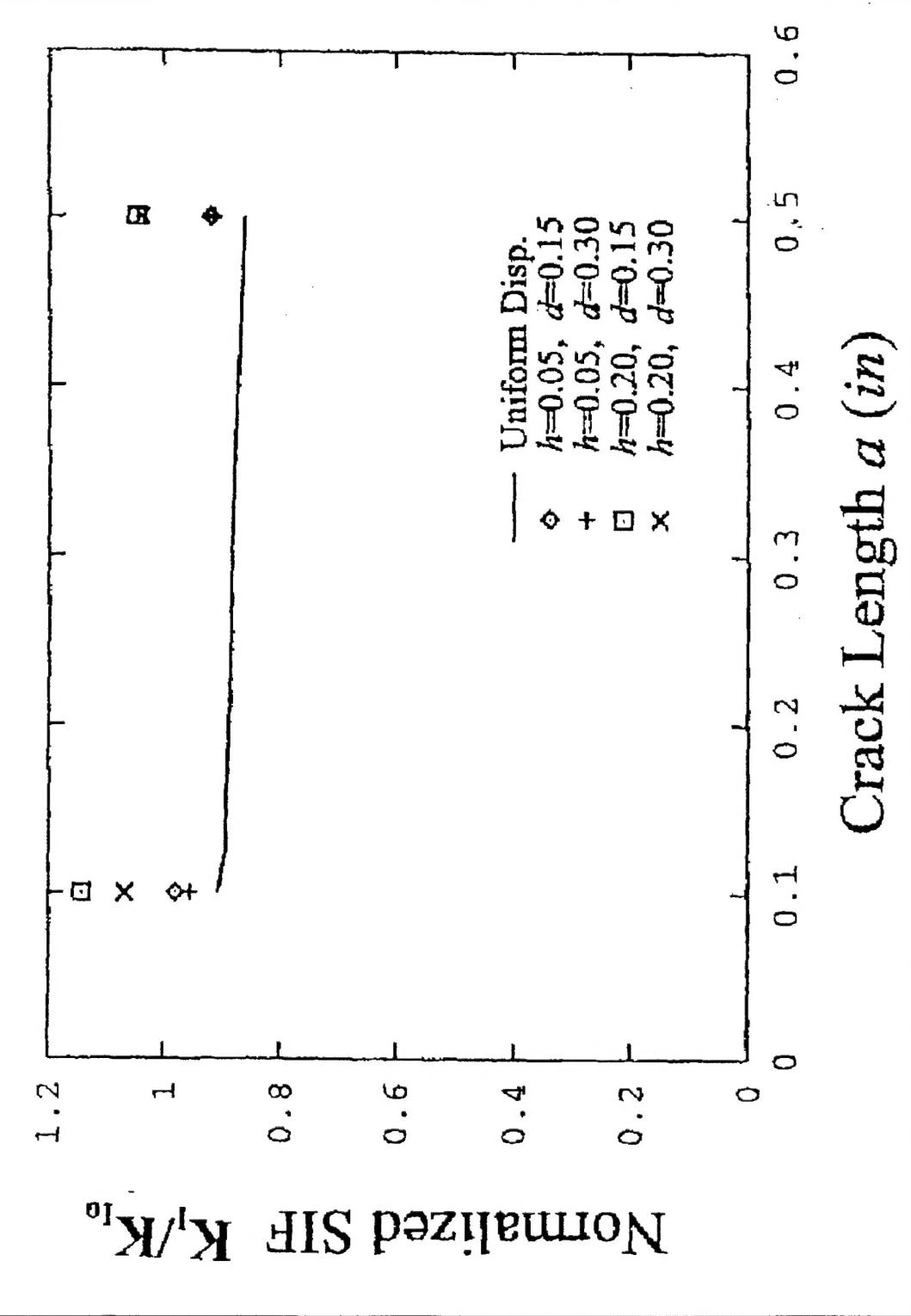
$$\left(\frac{K_I}{K_{IO}}\right)_{\text{Numerical}} = 0.8958$$

Normalized SIF Versus Crack Length

A1890

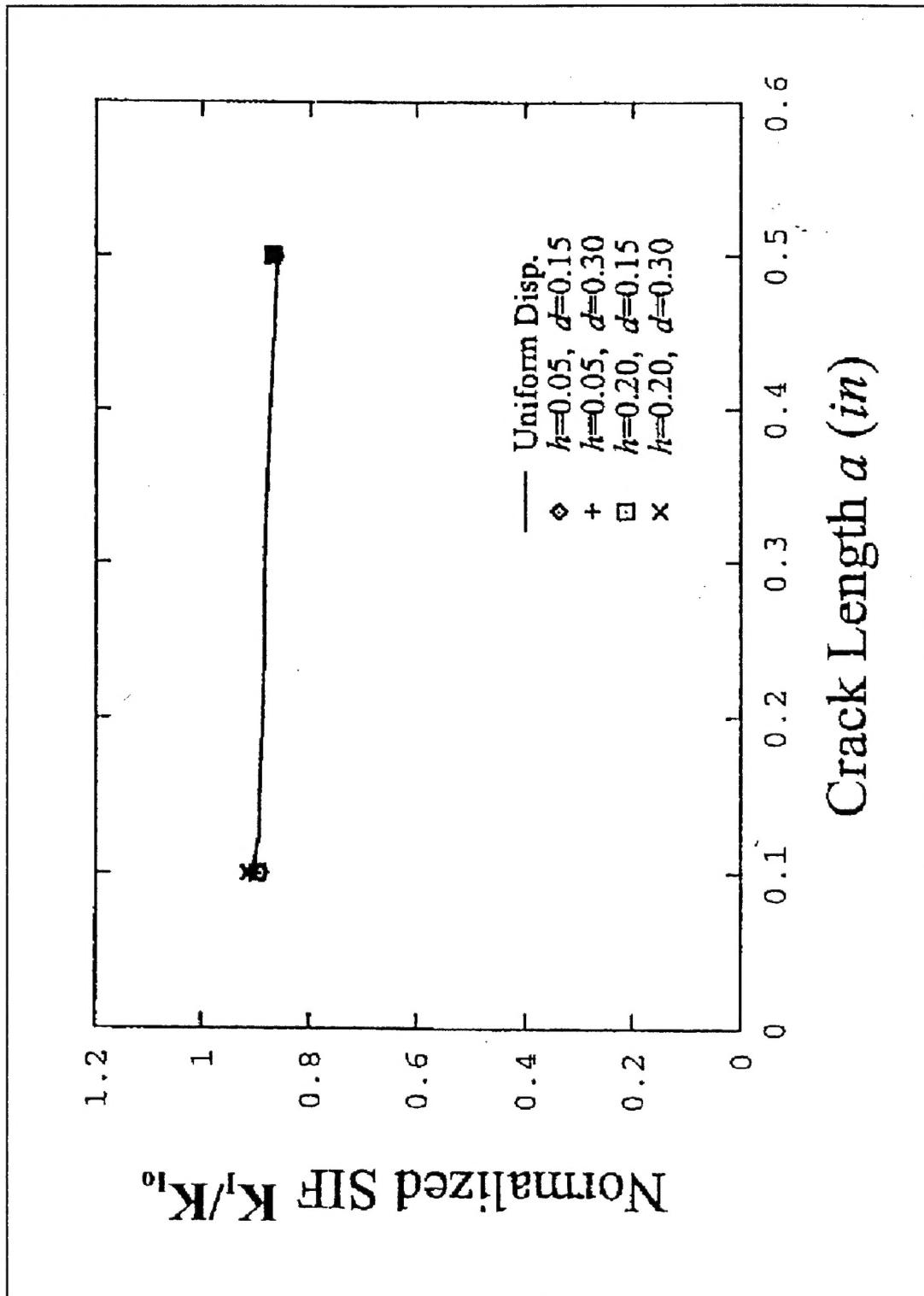
(adhesive layer is softer than material 1)

Normalized SIF K_I/K_{I_0}



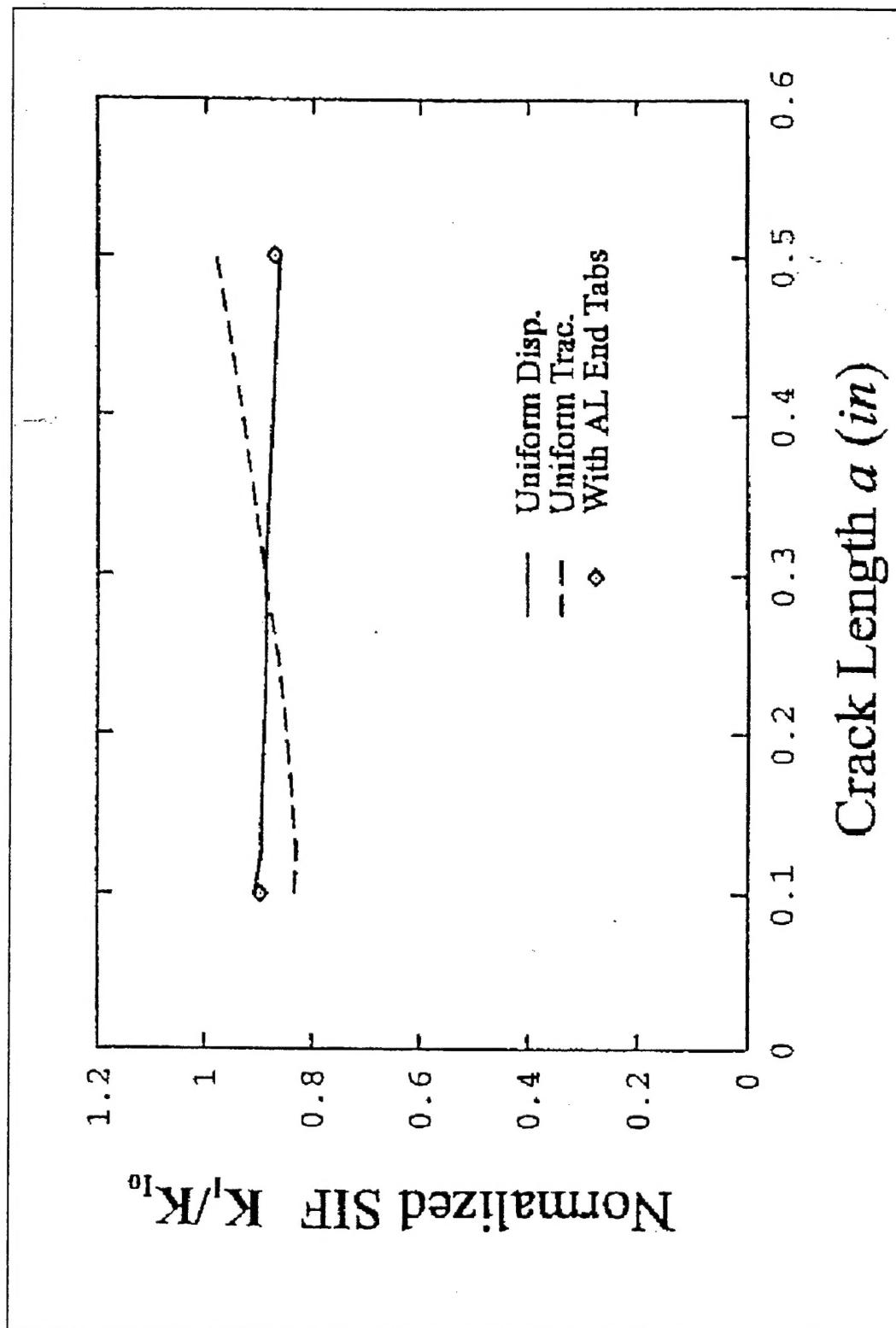
Normalized SIF Versus Crack Length

(adhesive layer is stiffer than material 1)



Normalized SIF Versus Crack Length

(adhesive layer has same material property as material 1)



Conclusions

- For all the cases analyzed, the Mode II stress intensity factor is negligibly small.
- By comparing with the homogeneous specimen, a softer (stiffer) adhesive layer has a significant (insignificant) effect on the normalized Mode I stress intensity factor⁽¹⁾ whereas a stiffer layer has an insignificant effect.
- For a soft adhesive layer, the normalized Mode I stress intensity factor increases with increasing the thickness of the adhesive layer.
- For a stiffer adhesive layer, the normalized stress intensity factor is insensitive to the thickness of the adhesive layer.

